ENERGY $AVER$

"... For Business and Industry".

VOLUME 1 / NUMBER 1

ENLIGHTENMENT ON NEW FLUORESCENT SAVINGS

The Facts...

Simple changes can yield big savings. Lighting accounts for about 28 per cent of electricity used in commercial office buildings in Alberta. Most of this electricity is used in fluorescent lighting. Changing to low-wattage fluorescent tubes can reduce the electrical energy used in fluorescent tubes by 15 to 20 per cent. This change-over is an easy step that a progressive manager can take to save on lighting costs.

Fluorescent lamps introduced in the 1930s were considered a real breakthrough in lighting technology. A 40-watt fluorescent tube produced as much light as a 150-watt incandescent bulb.

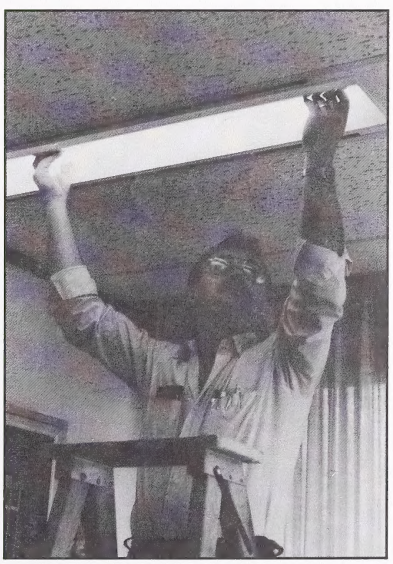
The first of the low pressure gas discharge fluorescent tubes to be introduced was the "preheat" type. When energized, a preheat stage is used to ionize the gas in the tube before an electric arc is struck.

The preheat tube was followed by the "instant start" in the 1940s. The "rapid start" tube, probably the most popular fluorescent tube in use today, was introduced in the 1950s. The four-foot 40-watt models are today's standard tubes.

The technology for fluorescent tubes has continued to improve. Low wattage tubes were introduced in the mid-1970s in response to energy conservation demands. These can be used in place of the standard 40-watt tubes, and have proven reliable and cost effective.

Changes in the gas mixture within low-wattage tubes, and different blends of phosphor coatings on the tube walls, have resulted in six watts of energy savings per tube. These 34-watt tubes provide light output similar to the standard 40-watt tubes, and can reduce the cost of lighting by 15 per cent.

Additionally, built-in switches in the latest models of the low-wattage tubes disconnect the cathode preheat circuit when the lamp is on, saving another two watts. The 32-watt, low-wattage tubes save a total of 20 per cent in energy costs, with only slight loss of light. These tubes are now available in the normally used range of wattages and sizes.



Les Kranic, building superintendent of the Essex Building in Edmonton, checks a fixture that has been converted to low-wattage fluorescent tubes.

A few ballast failures were reported during some of the early conversions to low-wattage tubes. These ballasts, however, were old and nearing the end of their service life. Low-wattage tubes have the same life expectancy as standard fluorescent tubes — 10 000 to 20 000 hours.

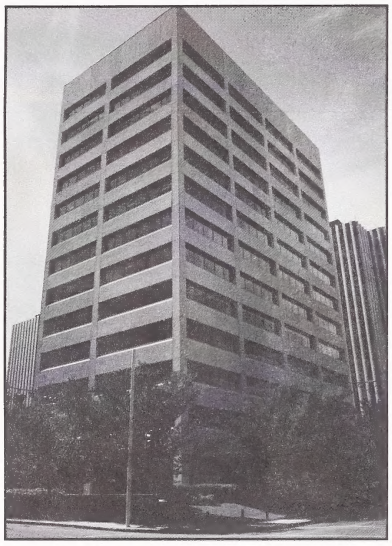
In Alberta, electricity generally costs more than any other form of energy. Using it wisely and efficiently can yield big savings. Replacing 40-watt standard fluorescent tubes with low-wattage (32-watt or 34-watt) tubes, will help building managers to significantly cut operating costs.

The Application...

The Essex Building is a 13-storey, owner occupied, large office building in Edmonton with 115 000 square feet (10 700 square metres) of floor area. Les Kranic, building superintendent, was concerned about high utility costs. To get help assessing the energy use, and to identify areas of potential savings, he requested the Alberta Energy Bus to conduct an energy audit of his building. Following suggestions of the audit team, he installed low-wattage tubes.

To reduce the conversion costs, all the tubes were replaced at the same time. This allowed Kranic to take

advantage of bulk prices and the early benefit of reduction in energy and demand costs. He used his own staff to change the tubes in the building to save labor charges. The entire cost of conversion came to about $5 500 which included the price of 3 200 new tubes. This simple conversion is now saving 50 000 kilowatt-hours (kW•h) or about $2 500 a year in electrical costs. The investment payback has taken a little over two years.



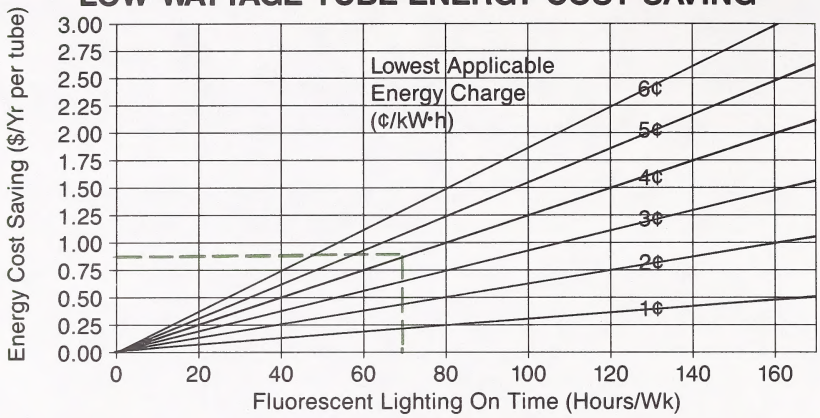
The cost saving advantage of low-wattage fluorescent tubes has been demonstrated at Alberta Energy Company's Essex Building in Edmonton.

An Energy Bus re-audit of the Essex Building was carried out after the lighting retrofit. It showed that the energy used for lighting had dropped from over 1 000 000 kW•h in 1983, to about 760 000 kW•h in 1986 — a saving of about 24 per cent. This large saving is due to a combination of converting to low-wattage tubes and simply shutting lights off when they are not needed.

The Bottom Line...

The example of the Essex Building shows that a simple change-over to low-wattage fluorescent tubes is a very worthwhile energy conservation measure.

LOW WATTAGE TUBE ENERGY COST SAVING



The easiest method of determining the economic merits of an energy conservation measure is by calculating the payback period. Anything in the order of two years or less is considered to be very good and worth implementing.

Simple payback is calculated by dividing the cost of conversion by the annual savings. To check their forecast annual savings, building managers can use the accompanying graph and technique described below. The cost of electrical energy and demand should be based on the rates from the utility that serves the building in question.

The graph shows the potential electrical energy cost savings per year for a single low-wattage fluorescent tube. Savings are based on the number of hours lamps are on per week and the lowest electrical energy charge that applies at your building (probably in the range of 1¢ to 6¢ per kW•h). The green line on the graph shows the potential cost savings for the example calculation below.

In addition, low wattage tubes provide a reduced electrical demand that results in further cost savings. Obtain the electrical demand charge for your building from your electric utility representative. It is very likely to be in the range of $2 to $14 per kilowatt (kW) per month. Multiply by 12 months per year and multiply again by 0.006 kW savings per tube to give the total demand cost reduction per tube. This calculation is illustrated in the example below.

EXAMPLE: Convert 250 tubes from 40-watts to 34-watts each.
Lowest applicable energy charge is 4¢/kW•h
Demand charge is $6/kW per month.
Lights are on 70 hours per week.
Low-wattage tubes are purchased for $2 each.

Electric energy cost savings (using graph)	=	$0.90/yr. per tube
Electric demand cost savings:		
$\frac{\$6}{\text{kW/month}} \times \frac{12\ \text{months}}{\text{year}} \times \frac{0.006\text{kW}}{\text{tube}}$	=	$0.43/yr. per tube
Total electric cost savings	=	$1.33/yr. per tube
Annual savings $1.33/yr. per tube × 250 tubes	=	$333 savings
Conversion cost $2/tube × 250 tubes	=	$500 cost
Simple payback $\frac{\$500\ \text{cost}}{\$325\ \text{savings}}$	=	1.54 years

SECTOR REVIEW

Electric Energy Use in Large Office Buildings...

Energy use varies widely, depending on the type of facility and the activities which take place at the facility. The extent to which energy use varies has become evident following Energy Bus audits of almost every type of energy-use facility in Alberta.

An energy audit initially determines how energy is currently being used and how much it costs in each area. Energy conservation measures are then identified which may result in energy cost savings. On average, the Energy Bus has identified a potential saving of approximately 20 per cent.

Figure 1 shows total energy use for large and small office buildings. In this analysis, an office building is considered to be large if it has heated or cooled areas totalling 50 000 square feet (4650 m²) or more. In Alberta, natural gas is the least expensive form of energy. The average price of a unit of electrical energy is 4½ times more than the equivalent unit of natural gas. Therefore, when analysing energy use, the energy cost must also be considered. Figure 2 compares energy use and cost in large office buildings.

Lighting represents 27.7 per cent of the electrical energy used in large office buildings, as shown in Figure 3. Of the different types of office building lighting, fluorescent tubes are the most commonly used, as identified in Figure 4.

Energy Bus audits have identified considerable potential for reducing lighting costs. Simply switching lights off when they are not needed frequently offers big savings due to the reduction in the kilowatt-hours used. Removing unnecessary lights and changing to more efficient light sources reduces electric demand as well as electric energy charges. Task lighting to light the work surface

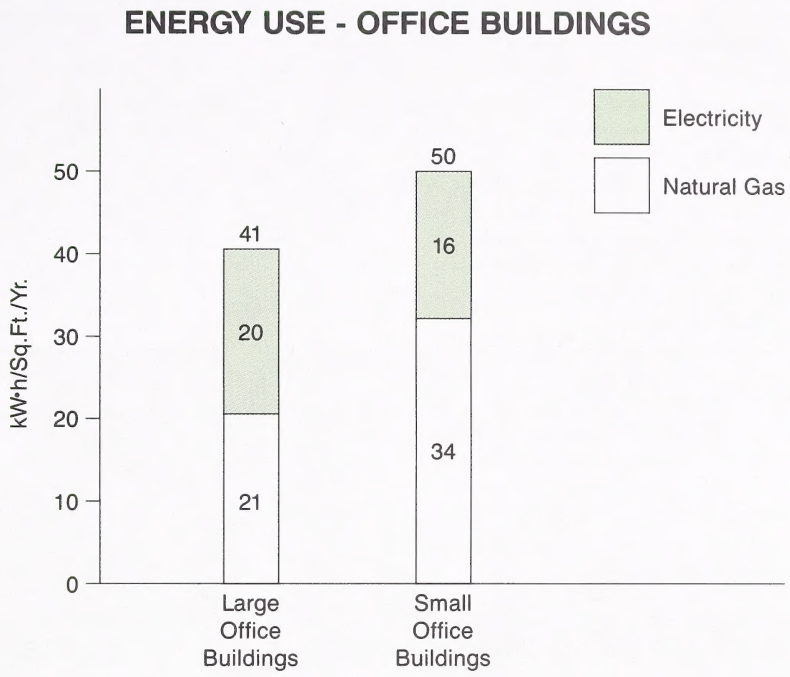


FIGURE 1 (Multiply by 10.76 to convert to kW•h/m²/Yr.)

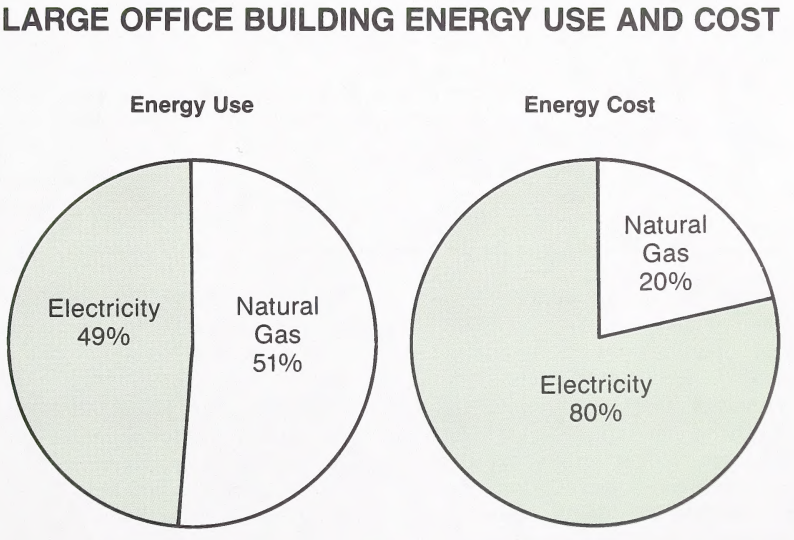


FIGURE 2

rather than a whole room results in reduced electrical use. Also available are devices such as add-on current limiters, energy efficient ballasts and motion detector switches which have the potential to reduce electric utility cost.

Replacing standard fluorescent tubes with low-wattage, energy efficient tubes will reduce the fluorescent fixture (tubes and ballast) energy use by 13 to 15 per cent. As fluorescent lighting represents 86.5 per cent of the total lighting costs, the use of low-wattage tubes will result in significant savings.

Since the difference in purchase price between the low-wattage tube and the standard tube is now minimal, the tubes can be converted as they burn out, allowing this conservation measure to be implemented without a large single capital investment.

Changing the lighting in a large office building to low-wattage fluorescent tubes is an easily implemented energy conservation measure that results in immediate cost savings.

ELECTRICAL ENERGY USE IN LARGE OFFICE BUILDINGS

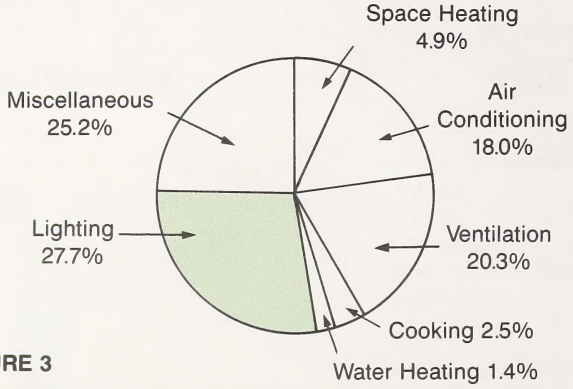
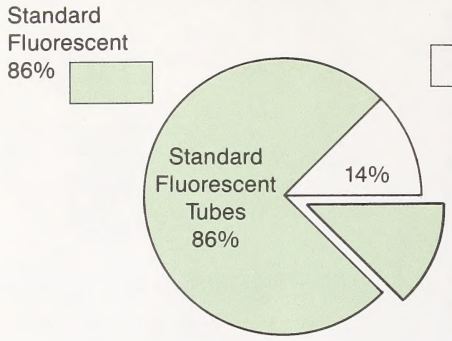


FIGURE 3

ENERGY USED BY TYPES OF LIGHTING IN LARGE OFFICE BUILDINGS



Potential Energy Savings:
13% of 86% when standard tubes are converted to low-wattage fluorescent tubes.

FIGURE 4

FOR MORE INFORMATION

The article Enlightenment on New Fluorescent Savings was researched by Dave Whitfield, and the Sector Review completed by Les Sladen. For detailed information on energy cost saving calculations and the energy audit database, contact the industrial section of the Energy Conservation Branch: Phone (403) 427-5200.

ENERGY $AVER$

Energy $aver$ is a series of fact sheets about energy conservation measures that have wide application in Alberta. Each issue highlights a different technology and its successful use in the province. The Sector Review summarizes energy use patterns of different facilities that have used Alberta's Energy Bus audit service. Comments, questions, and suggestions are welcome.

Write or phone (collect) to be placed on the mailing list. You may also receive back issues or arrange for an Energy Bus audit (conducted at no charge).

Alberta Department of Energy
Energy Conservation Branch
2nd Floor, 10010 - 106 Street
Edmonton, Alberta, T5J 3L8
Phone 427-5200

Pub. No. I/249 1989
ISBN 0-86499-5660

Alberta
ENERGY
Energy Conservation Branch